With the Author's Compliments.

Transplantation of Ureters

Into the Rectum for Exstrophy of the Bladder. By the Author's Extra-Peritoneal Method. Three Additional Cases.

... BY ...

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—*British Medical Journal*, September 3rd, 1898.

Hydatid Cyst of the Tail of [illegible] eas.

—*Canadi[illegible] and Review*, February, 1901.

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(1) Transplantation of the U[illegible]nto th[illegible] Rectum by an Extra-Peritoneal Method for Exstrophy of the Bladder.

(2) New Operation for Procidentia Recti.

—*British Medical Journal*, June 22nd, 1901.

A New Wrench for Use in the Correction of Stubborn Deformities.

—*Canadian Journal of Medicine and Surgery*, December, 1901.

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(1) A New Method of Cutting Urinary Calculi.

(2) A Case of Unusually Large Calculus Removed by Suprapubic Section.

—*Canadian Practitioner and Review*, January, 1902.

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(1) A Case of Dilatation of the Œsophagus without Intrinsic Stenosis.

(2) Removal of Foreign Body from the Œsophagus.

—*Canada Lancet*, March, 1902.

Transplantation of Ureters

I. TO THE RECTUM FOR EXSTROPHY OF THE BLADDER—BY THE AUTHOR'S EXTRA-PERITONEAL METHOD

THREE ADDITIONAL CASES.

... BY ...

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TRANSPLANTATION OF URETERS INTO THE RECTUM FOR EXSTROPHY OF THE BLADDER—BY THE AUTHOR'S EXTRA-PERITONEAL METHOD.—THREE ADDITIONAL CASES.*

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In the issue of the *British Medical Journal* of June 22nd, 1901, I reported a case (Case No. 1) of the above-named operation performed on a child, B. S. G., aged five, on the 15th July, 1899. It is now more than two and one-half years since that operation was performed, and the boy remains in perfect health, is growing normally, and to all appearance is as healthy and strong and happy as any other boy of his age. (Present exhibited.)

Recently three other cases of exstrophy of the bladder have been under my care, and have been submitted to the same operation, with results up to the present satisfactory in two cases, while operation in the third case was followed by death on the fifth day, from acute ascending infection.

The method of performing the operation in these three cases was practically the same as that described in the article above referred to, and for the benefit of those not familiar with this article, may be briefly summarized as follows:

The first step of the operation is to insert a small rubber catheter, about No. 5 to 7, into each ureter, passing it in about 2 1-2 or 3 inches, so that its upper end reaches beyond the [illegible] the ureter over the brim of the pelvis. The catheters are [illegible] by passing a very fine silk suture through the wall of the [illegible] through the wall of the papilla, so as to take a [illegible]. The object of thus stitching the catheters into position is [illegible] may not become displaced while the transplantation is being [illegible] but may remain in position for from 24 to 60 hours [illegible] drain away all the urine out of the anus after the operation is completed. (Though I have always followed this method, my experience in Case 4 makes me question whether it would not be well to dispense altogether with the use of the catheters).

* Read before the Toronto Medical Society.

The next step consists in dissecting out the distal ends of the ureters with a fair-sized rosette of the adjacent mucous membrane and muscle wall of the bladder. In making this dissection, my experience teaches me that the safest and easiest method is to commence the dissection at the portion of the papilla nearest the pubes, as it is quite certain that here, at all events, the ureter will be uncovered by the peritoneum. One soon enters a cellular space through which the ureter with its contained catheter can be easily felt, and with the finger in this space the dissection is proceeded with, being exceedingly careful not to injure the peritoneum, which lies very close to the ureter at the upper part. However, with care there is, I think, practically no danger to the peritoneum, and in none of my cases have I any reason to suspect that the membrane was injured or molested. It will be found when the circular rosette of bladder tissue has been completely separated, that the remainder of the ureter can be easily dissected free, and care should be taken without any traction to follow it back in its curve, so that it will, when transplanted into the rectum, run practically in a straight line from the brim of the pelvis to its new situation in the wall of the rectum.

This part of the operation having been completed on both sides, the surgeon's attention is next directed towards laying bare the lateral wall of the rectum. This must be done largely, of course, by blunt dissection, and the process is very greatly facilitated by the presence of one finger of the operator or his assistant in the bowel. The absence of the pubic arch renders it comparatively easy to lift the rectum towards the wound of operation, and thus bring it almost to the surface. If care is taken to keep well to the lateral aspect of the pelvis during this dissection, and to approach the rectum from this direction, the peritoneum is not endangered, but this portion of the operation should be conducted with extreme care, as it is difficult to tell how low down the peritoneum may reach in these abnormal cases, and the essence of my operation is its completely extra-peritoneal character.

The point selected for planting the ureter is that on the lateral aspect of the bowel (Fig. 2, B), just above the internal sphincter, and it has been found in every case that the ureter could be brought to this position without the least trouble.

Having thus determined upon and exposed the seat of implantation, a pair of forceps is passed into the rectum, and pressed against the selected spot. A slight cut is now made from the external wound upon the end of the forceps; this is forced through, and the little wound dilated very accurately, so that it will receive snugly and yet without compression the ureter with its contained catheter. The forceps is then passed through and made to seize the end of the catheter, and this is drawn through

the rectal wound and out of the anus. The forceps is then passed back beside the catheter through the same opening and made to grasp lightly the distal end of the ureter, or rather its rosette of bladder tissue, and this is now carefully conducted through the opening and made to protrude into the rectum. Very great care should be taken not to injure the ureter during this operation.

The same tactics are repeated upon the opposite side, and thus the ureters are drawn through so that their distal ends together with the rosette of bladder tissue, are made to project into the rectum as two prominent papillæ (Fig. 2, B). The catheters, of course, pass out through the anus, and are directed into the mouths of separate bottles containing a solution of carbolic or boracic acid. In this way one can ascertain that both kidneys are working, and if one catheter should become plugged (as happened in one of my cases) with urates or phosphates, it may be immediately withdrawn.

It will be observed that no effort is made to stitch the ureters into position. In fact, I have not found this at all necessary in any case. There is nothing to cause them to move out of their position, and the vitality of the ureters is not impaired by the traumatism which would result from such suturing. In order, however, to support the delicate ureters in their new position, and to prevent the injurious effects of any extravasation that may occur from the rectum to the wound in the pelvic cellular tissue, the wounds are packed on each side fairly firmly with iodoform gauze. This is left in position for two or three days, and when removed it is found that the parts fall together without, as a rule, allowing any extravasation from the rectum; or if there should be any, as happened in my third case, the gauze affords sufficient drainage, and the wound heals quickly by granulation.

The treatment of the exstrophied bladder tissue will depend upon the amount of bladder tissue exposed, and upon the extent of the hiatus in the abdominal wall. In my first and third and fourth cases, I found that all that was necessary was to dissect away the exposed mucous membrane of the bladder, which in these three cases was not of any great extent, and allow the whole to heal by granulation. In my second case, however, the closure of the hiatus in the abdominal wall called for a very considerable plastic operation, which I shall presently describe.

Case 2.—G. R. H., male, aged 13. His family history is good. He has five brothers and two sisters all healthy. He is the youngest of the family. There is nothing in the personal history of any importance except the physical condition for which he entered the hospital, viz.: exstrophy of the bladder, which is, of course, congenital. He was at the time of admission a fairly well-developed boy, but had an extremely listless, depressed and

ashamed appearance. He shrank from looking at any one, would not enter into conversation if he could help it, and evidently was extremely conscious of and sensitive to his defective development. He was attired partly in female garments, and altogether presented an aspect such as to excite pity.

On examination it was found that the exstrophied bladder was of considerably more than the average size, being about 3-12 inches in diameter, and more or less circular in outline. The ends of the pubic bones could be plainly felt, being separated in an interval of about two inches, the symphysis, of course, being entirely absent. The bladder bulged forward in the erect posture to a considerable extenf, constituting a partial hernia at the part. The urethra was, of course, merely represented, as in all these cases, by a slight gutter, which occupied the upper aspect of the imperfect penis, and the prostate with its normal openings could be seen at the junction of this gutter with the bladder. The ureters ended in two quite prominent papillæ, from which the urine escaped more or less constantly, but with slight intervals, representing, no doubt, the peristaltic action of the ureters. The exposed bladder-wall was ulcerated over about one-third of its area, and was exceedingly sensitive to the touch, so much so that the patient was extremely apprehensive of any attempt at examination, and also suffered in walking from the mere contact of the dressings applied to collect the urine. The skin also of the pubes and scrotum was eczematous.

The operation as above described was performed on the 7th October, 1901. The catheters which had been fastened in the ureters, and projected from the rectum, came away spontaneously on the 9th, about 30 or 36 hours after the operation. No attempt was made to reinsert them in the ureters, but a tube was placed in the anus so as to drain the rectum constantly for the next two days. After that the urine was allowed to accumulate in the rectum. The packing placed in the wound was removed on the third day, and a small amount of gauze was re-packed in these opnings for the purpose of drainage. No extravasation of urine whatever took place, and the wounds healed rapidly by granulation. At first the urine came away almost constantly, the sphincter ani apparently having but little control of it. At the end of a week, however, he had very fair control, and could hold the urine without difficulty for an hour or two.

On the 17th October, ten days after operation, the history states that the patient passed urine only three times during the day and twice during the night, and on the 19th it is noted that he passed it three times during the day and four times at night. Up to this time the patient had usually passed fecal matter with the urine, but now he has noticed that frequently the evacuations contain urine only without any considerable admixture of feces.

On November 3rd, that is, a little less than a month after the operation, it is noted that he can hold his urine four or five hours without difficulty, but that he has better retentive power during his waking hours than during sleep. However, his control is perfect, so that he on no occasion soils the bed or his clothing. There is no irritation whatever about the anus, nor does the patient suffer any pain in the rectum or at the anus, either before or during evacuation.

On November 19th an operation was performed to remove the mucous membrane of the bladder and to close the hiatus in the abdominal wall. This was done in the following way: An incision was made at the edge of the skin, removing the narrow area of scar tissue between that and the bladder mucous membrane, and continuing the dissection over the whole of the exposed area of the bladder wall. This was done by a very careful and laborious dissection, as it was found extremely difficult to separate the bladder mucous membrane from the remaining coats, and it was deemed desirable to leave, if possible, all the muscular and fibrous elements of the bladder tissue for the sake of strength to the abdominal wall at this part. The dissection was accompanied by a great deal of capillary bleeding, which was stopped by pinching with forceps and twisting. Having removed the whole of the mucous membrane, two lateral flaps were raised by dissection so as to close the hiatus by a sliding movement towards the middle line. These flaps were made to include the whole of the skin, and every particle of fascia that could be raised from the muscular structures of the abdominal wall, and the undermining extended as far outwards as the anterior superior spine of the ilium on each side, and as low down as the lower border of Poupart's ligament. The parts were brought together in the middle line by means of relaxing and coaptation sutures. In removing the mucous membrane, the operator was careful not to encroach upon the openings of the seminal vesicles in the rudimentary prostate, so that this part of the mucous membrane, as well as the floor of the urethra, are still left.

The patient recovered from the operation promptly, and the wound healed slowly but satisfactorily, though not without some suppuration. It is now soundly healed, and the abdominal wall seems firm and good over the former hiatus.

On December 8th, two months after operation, the following note is made: The patient has had on an average during the past two weeks six evacuations in each twenty-four hours, the time between evacuations varying from two to six or eight hours. He is now up and walking about, without pain and without discomfort. His mental condition is improved in a very extraordinary degree. He is now bright and cheerful, takes an interest in his surroundings, converses agreeably with his fellow patients, and is learning

to read, and altogether to take a more intelligent and active interest in life.

March 3rd, 1902, five months after operation. The patient's father writes me that his son is perfectly well and able to retain his urine without discomfort for from two to six hours during the day, and that he is seldom disturbed at night by a desire to empty the cloaca.

Case 3.—Ada N., aged one year, female. Operation October 26th, 1901. The principal interest attaching to this case is due to the fact that it shows the possibility of performing this extra-

Fig. 1.—Exstrophy of the bladder in A. N., a female child, aged one year (Case No. 3).

A, the exposed mucous membrane of the bladder.

B, the introitus vaginæ, with the rudimentary labia majora at either side. Immediately above B is the inferior segment of the urethra.

C, a slight procidentia recti, cured before the transplantation by Van Buren's method.

Note the wide separation of the thighs due to the imperfection of the pelvic arch.

peritoneal operation with safety in the female as well as in the male, and in children of very tender years. However, though this case terminated successfully, I would not again attempt the operation on so young a child, unless the conditions were extremely urgent. The operation is one which calls for very delicate handling of parts so fragile as those of a child of this age, and the handling of the ureters, and the passage of catheters into them is not unattended with shock, which, of course, is ill-borne by so young a patient. Children of this age are, moreover, subject to the penal-

ties of teething, and in the case now reported the main troubles of the patient seem to be traceable to that condition.

The operation performed on this little patient differed in no respect from that previously described, except in the fact that great care had to be observed in passing down to the rectum by the side of the vagina. However, this was safely accomplished; the rectum was reached without encountering the peritoneum; and the transplantation was made in precisely the same way as that above described. Here again it was found perfectly easy to bring the ureters down very close to the internal sphincter, where the transplantation was made. Though the vagina escaped injury during the transplantation, a slight wound was made in it in the act of dissecting away the remains of bladder mucous membrane, which in this case was very small in amount. However, this wound seems to have healed kindly, leaving a patent vagina. In this case one of the catheters became plugged with urates at the end of forty-eight hours, so that no urine whatever came from it. Both catheters were consequently removed. The packing was not removed in this instance till the third day, and on the left side some extravasation of urine, and a little fecal matter occurred, and persisted for some weeks. Ultimately, however, the fistula closed spontaneously. I attribute this leakage to the fact that probably the opening into the wall of the rectum on the left side had been made rather too large. It is quite clear, I think, that had the peritoneum been wounded in this case death from peritonitis would have resulted from this leakage.

The subsequent history of this case could not be described as uneventful, but the least of the child's troubles were those pertaining directly to the operation. In fact, as far as the operation area itself was concerned, the result was, with the exception of the occurrence of the fistula above noted, quite satisfactory. The other troubles from which the child suffered need not be described in detail, but may be noted as consisting of bronchitis, swollen gums apparently accompanied with great pain, double purulent otitis media, and worms. However, the child gradually survived all these conditions, and was taken to her home ten weeks after the operation, in very fair and rapidly-improving health.

The day before she left the hospital I examined the rectum with the finger. On the right side there was a prominent papilla, representing the lower end of the implanted ureter; on the left side the papilla could be felt, but was much less prominent. The fistula above referred to had entirely closed, and the patient's general health was improving rapidly. There was a slight degree of irritation between the nates, but not immediately around the anus, and not more than is frequently present in children of this age. The child apparently had complete control of the sphincter,

but evacuations occurred every hour or two. She seemed to suffer no pain or discomfort from the presence of the tube in the rectum.

February 24th, 1902. Four months after operation. The mother writes me that the babe is gaining in strength and weight, "quite smart and lively," beginning to walk, and able to hold the urine from one to four hours during the day, and sometimes for half the night.

Case 4.—R. B., male, aged 4 1-2 years. This case of exstrophy of the bladder upon whom I proposed to operate seemed to me to be the most hopeful subject that I had yet attempted, but the event proved that a fatal issue followed on the fifth day, clearly from one of the greatest dangers of any operation for transplanting the ureters in the rectum, viz.: an ascending infection which reached the kidneys. The anatomical condition was a typical one, and need not be further described.

The operation was performed on January 24th, 1902, and was done precisely as narrated in the preceding cases. The whole of the bladder tissue was removed with ease, and the raw surface left was brought together by silk worm-gut sutures from above downwards, so as to convert the wound into a line running transversely. The central portion of the wound was left unstitched, and packing of iodoform gauze was placed in its depths down to the level of the point of implantation of the ureters. The child seemed to recover well from the shock of operation, and the next day was fairly bright and took nourishment well. He had some vomiting, which continued for twenty-four hours. The catheter on the left side came out in about eighteen hours after the operation, and no attempt was made to replace it, but a tube was placed in the rectum to drain away the urine which poured out from the left ureter. This seemed to act perfectly well. Twenty-four hours later the other catheter came out, but the rectum continued to be drained by means of the tube, and this appeared to work quite satisfactorily. On the second day after operation he began to become drowsy, and the condition deepened continuously until the time of his death. His temperature rose before death to 101 4-5ths, which is the highest point recorded.

The amount of urine decreased, though it never ceased altogether, and never had the appearance of containing blood. He did not suffer from vomiting, diarrhœa, or convulsions, and, in fact, almost the only uremic symptom which was present was the coma, and this was never very profound. His death took place on the morning of the fifth day after operation.

Post Mortem Examination.—The external wound was perfectly healthy in appearance, and on removing the stitches it was found that healing was advancing quite satisfactorily. There was no suppuration whatever, nor was there the least extravasation of urine

rom the rectum into the wound. On opening the abdomen, it was found that the peritoneum was perfectly healthy, and that the operation wound had not in the slightest degree injured that membrane. The kidneys were found to be swollen and deeply congested, presenting evidence of active inflammatory infection. There was fibrinous material. The ureters contained a few drops of urine, which was loaded with germs, apparently from the rectum. There

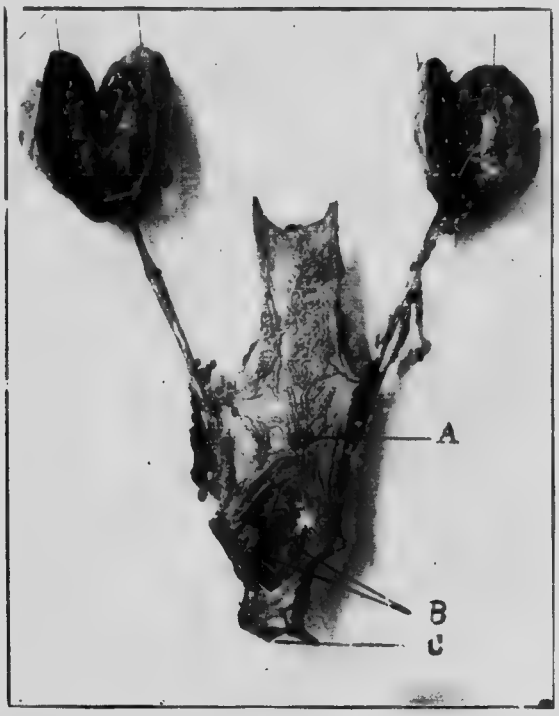

FIG. 2.—Specimen from R. B. (Case No. 4).

A, rectum laid open along its posterior aspect.

B, the prominent papillæ, consisting of the ends of the transplanted ureters with a rosette of bladder tissue. (Note that the implantation is upon the lateral aspect of the bowel.)

C, the anus. The stretching of the specimen in preparation makes the implantation appear unduly high in the bowel.

was no obstruction of the flow from the ureters, as would have been indicated by dilatation of these tubes and the pelvis of the kidney. On removing the kidneys, ureters, rectum and anus, it was found that the implantation had been carried out in a thoroughly satisfactory manner. The papillæ, as seen in the photograph (Figure 2, B) presented quite prominently on the rectal mucous membrane. They were clearly in a viable condition, and if the patient had

survived certainly would not have sloughed, but would have persisted as prominent papillæ, as I have described as occurring in my other cases. The rectum itself showed no signs of inflammation, nor was there any eczematous condition about the skin of the anus.

Pathological Report by Prof. J. J. McKenzie, University of Toronto: The gross condition of the kidneys is one of acute nephritis, with some dilatation and congestion of the ureters; the right kidney showed somewhat more acute change than the left.

The microscopic examination of the fluid in the pelvis of the kidneys showed the presence of large numbers of bacteria, red blood corpuscles and masses of epithelium mixed with crystals of ammonio-magnesium phosphate and of uric acid.

Cultures from the pelves of the kidneys showed that the bacteria which were present were chiefly of four types, viz.: the commonest form was a variety of the proteus bacillus; with this was associated the colon bacillus, a staphylococcus and a streptococcus.

A study of the sections showed a condition of diffuse nephritis which was most marked in the pyramids; there was an almost complete desquamation of the epithelium in the larger collecting tubules and papillary ducts; the latter contained, besides masses of epithelium, zoogloeal collections of bacteria which consisted largely of bacilli.

Judging from the results of *post mortem* examination, and from the bacteriological examination which was made for me by Professor McKenzie, I have not the slightest doubt that this case proved fatal through an infection which spread up from the rectum through the ureters to the kidney. As I have stated above, I am strongly disposed to think that this might not have occurred had I not inserted the catheters, as the presence of these tubes prevented the papilla-valve from acting properly.

Remarks.—In the description above given of the method of performing this operation, it will be noticed that I have departed slightly from that given in regard to my first case.* Fuller experience has taught me that though it is desirable to dilate the sphincter, it is not necessary to insert the sponge in the rectum, as therein advised. It is, however, advisable to wash out the rectum as well as possible by an enema given some hours previous to the operation; and again, at the time of operation, to allow some mild antiseptic like boracic acid to flow in and out of the rectum to render it as nearly aseptic as possible. Again, in the detail of making the wound in the wall of the rectum and drawing the catheter and ureter into it, I think it is distinctly better for the surgeon to have his own finger in the rectum, allowing his assistant to do whatever may be necessary in the part of the wound above the pubes.

In a paper of this kind it is, of course, impossible to go

fully into the literature of the subject, or even to mention all experimental and clinical work that has been done in this direction. I would refer those specially interested to a paper entitled, "Anastomosis of the Ureters and the Intestine," by Peterson, of Ann Arbor, formerly of Chicago. Peterson's conclusions refer to the exceedingly high mortality of the operation both in animals and in man; to the difficulty of technique, and to the very great danger of renal infection following the operation. He concludes, in fact, that the operation is unjustifiable in cases of exstrophy of the bladder, vesico-vaginal or uretero-vaginal fistula, or of malignant disease of the bladder, but he favors the performance of what is known as "Madyl's Operation," viz.: the transplantation of a vesical flap, including the uretral orifices, into the descending colon. He argues that there is no valve guarding the vesico-uretral orifice, and that neither the circular muscular layer of the ureter, nor the bladder muscles themselves, act as a sphincter.

As a result of my experience of these four cases *in the human subject,* I have reached widely different conclusions, and, in reply to objections, I would point out that the operation which I have described includes the natural termination of the ureter on the bladder mucous membrane, and that whatever virtue there may be in this peculiar termination is retained when the transplantation is completed by my method. Moreover, it is not possible for me to see what advantage there can be to the patient in retaining the trigone of the bladder itself. The operation as described above does not involve any section of the ureter, and maintains its circulation complete to the point at which its vessels anastomose with those of the bladder, thus obviating the danger of sloughing.

In one part of his paper he points out that any portion of the ureter projecting into the rectum will in any event slough off. Doubtless this may be true when the ureter is divided at any point in its continuity, but I am able to prove by my cases that when the papilla, with a portion of the bladder tissue surrounding it is implanted into the rectum, such sloughing does not occur, but the papilla remains (Fig. 2, B), and its mucous membrane in process of healing becomes continuous with that of the rectum, thus perpetuating a papilla similar to that by which all mucous ducts terminate upon a mucous membrane, such as the bile duct and the salivary ducts. I argue, moreover, that such a papilla *does* constitute a real and efficient valve; that it presents a very great obstacle to the spread of septic infection up the ureters, and I am disposed to think that, in Case No. 4, the rapidly fatal ascending infection might not have occurred if I had made the implantation without the use of the catheters in the ureters. Theoretically, the presence of the catheter prevents the action of the papilla-valve, and so fully

convinced am I of the efficacy of this valve, that in future cases I contemplate trusting solely to a tube in the rectum to carry off the urine, and so prevent its filtering through into the anterior wound. Even if the latter undesirable event should happen, the peritoneum is so safe, and the drainage so good, that little harm can result beyond delay in healing. In order to secure easy evacuation, and thus minimize the danger of squeezing any of the contents of the cloaca into the lateral wounds, I also think that the sphincter should be gently stretched at the time of operation. Moreover, my first case, now of more than two and one-half years' standing, shows not the slightest sign of any infection of the kidneys, nor do my other surviving cases of five and four months' standing respectively.

In conclusion, I submit that, by the method above described, one of the greatest dangers of the operation of implanting the ureters into the rectum in the past, viz: peritonitis—is practically eliminated, and that the other, viz.: ascending infection, while it will perhaps never be eliminated, is thereby reduced to a minimum.

From the point of view of the comfort and happiness of the patients, the result in the successful cases leaves nothing to be desired. They are able to retain the urine almost as long, and apparently quite as comfortably, as in the normal bladder. From being pitiable, useless—often disgusting—objects, they are converted into useful citizens able to take their part in life with comfort and self-respect.

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